

aeromet

SEASONAL PROGRESS REPORT NO. 5 for the period March, April and May 1977

to

ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
1860 Lincoln St., Suite 900
Denver, CO 80203

Contract No. 68-01-1946

aeromet inc.

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Aeromet, Inc. P.O. Box FF Norman, OK 73070 PLMILIDEATY
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1.0 INTRODUCTION

Low level temperature and wind data were collected for the spring season of March, April and May, 1977 at Casper, Wyoming; the Colorado C-b Tract 25 miles west of Rio Blanco, Colorado; Craig, Colorado; Escalante and Hanksville, Utah; Rock Springs, Wyoming; and the U-a/U-b Tract 5 miles south of Bonanza, Utah. The collection of data at the U-a/U-b site commenced October 1, 1976 and will continue through 30 September, 1977. The data were collected using a 30 gm helium filled pilot balloon with a temperature sonde attached, a single theodolite and a TSR-2 receiver/recorder twice a day every other day. The observations were made ½ hour after sunrise and at 1400L.

The pilot balloon had an ascent rate of 500 ft/min and it was tracked by a single theodolite for 12 minutes with the azimuth and elevation angles recorded every 30 seconds on a cassette tape recorder. The tape was transcribed to a pilot balloon form after the observation.

The temperature sonde operated at 403 MHz and the signal was received by a ground plane antenna at least 24 ft. AGL which was attached to the Aeromet, Inc. TSR-2 receiver/recorder. The TSR-2 receiver has a built-in Rustrak strip chart recorder and the temperature was recorded within the range from -50°C to +50°C. A baseline temperature calibration was performed with each T-Sonde by the adjustment of the recorded temperature to match the thermometer measured temperature next to the transmitting sonde. Once the calibration check was finished the balloon was released with the sonde attached and the temperature was recorded for at least 20 minutes. At the completion of each observation the data were mailed to Aeromet, Inc.

The Seasonal Progress Report is divided into seven parts, one corresponding to each of the seven field sites. The temperature and wind data were not edited after the completion of the Monthly Progress Reports.

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2.1 Mixing Layer Height

The average mixing layer height was computed for the morning and afternoon based on the morning and 1400L temperature soundings. balloon release ½ hour after sunrise is near enough to the minimum temperature to assume the correctness of the calculated mixing layer heights. The afternoon balloon release is generally not at the time of maximum heating and the user of the mixing layer height data must be aware that minor changes in the calculated values can be expected. Without equipping the field sites with minimum/maximum thermometers the extrapolation of the afternoon data cannot be justified in establishing a data base for statistical analysis. The approximation of the afternoon maximum temperature would be a "calculated guess" for there are: 1) local effects which are to be determined and would be filtered out with extrapolation, 2) mountain effects which alter the lower 1500m (e.g. downslope effects), and 3) meteorological effects which can alter the expected change in the sounding (e.g. advection, moisture, etc.).

It is felt that to better define the mixing layer height a variety of "heat island" effects should be viewed. The rigourous method would be to define 15 "heat island" effects ranging from 0 to 14 °C and let the user decide which would best serve his needs. However, for this analysis 0°, +5° and +10° "heat island" effects are calculated and listed for the morning and afternoon soundings in the table Average Mixing Layer Height.

A summary of the average mixing layer heights calculated with the 0°, +5° and +10° "heat island" effects for each of the seven field sites for the spring season of March, April and May 1977 are included in the report. The percent of occurrence of the average height within 250m increments above ground level is given in tabular form. The total number of soundings included in the sample populations are listed in the table.

2.2 Stability and Inversion Classification

The temperature and wind data were edited to remove data felt to cause anomalous results in the stability and inversion classification schemes. Only the stations listed prior to the table classifying the inversions were used in the calculations.

The temperature data are processed to produce for each site a seasonal summary of inversion layers and lapse rates within the inversions and from the inversion base to the surface by means of the Holzworth classification scheme for inversions (Holzworth, G. C., 1974: "Climatological Data on Atmospheric Stability in the United States" paper presented at the American Meteorological Society Symposium on Atmospheric Diffusion and Air Pollution, September 9-13, 1974, Santa Barbara, California.)

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The temperature and wind data are processed together to produce for each site a monthly average bivariate frequency distribution of wind direction versus wind speed represented in the 500m layer adjacent to the ground. The distribution is presented by the six Pasquill stability classes (A-F) and a summary independent of stability. If the $\Delta T/100m$ criterion is met but the wind speed criterion is not met, then the wind data are checked against the criterion

STABILITY CLASS	ΔT (°C/100m)	WIND SPEED (m s ⁻¹)
А	<-1.9	≤2
В	-1.91.7	≤5
С	-1.71.5	≤6
D	-1.50.5	ALL SPEEDS
Ε	-0.5 - 1.5	≤5
F	>1.5	≤3

for the next stability class, always cascading to the D stability class. Once the wind speed criterion is met the data are classified under the new stability class even though now the lapse rate exceeds the class criterion. For example, if the $\Delta T/100$ m value is 1.7 and the wind speed is 7 m s⁻¹, the lapse rate criterion is met for the stability class F, however the wind speed criterion is exceeded. The wind speed is greater than the 5 m s⁻¹ maximum limit for class E but falls within the criterion of class D, which includes all wind speeds. As a result the observational data with a ΔT value of 1.7 C/100m and a wind speed value of 7 m s⁻¹ are classified under stability class D, not class F.

The data are also punched on computer cards in a format compatible with the STAR PROGRAM of the National Climatic Center, NOAA, U.S. Department of Commerce. A detailed description of the punched output can be found in the Monthly Progress Reports.

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AVERAGE MIXING LAYER HEIGHT

Utah U-a/U-b Tract

Season: March, April, May 1977

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251 - 500m	2.3	18.6	18.6	13.6		
501 - 750m		9.3	16.3	2.3	6.8	
751 - 1000m		2.3	7.0	11.4	9.1	
1001 - 1250m				6.8	15.9	
1251 - 1500m		2.3	9.3	6.8	6.8	2.3
1501 - 1750m		2.3	2.3		15.9	13.6
1751 - 2000m		2.3	4.7			9.1
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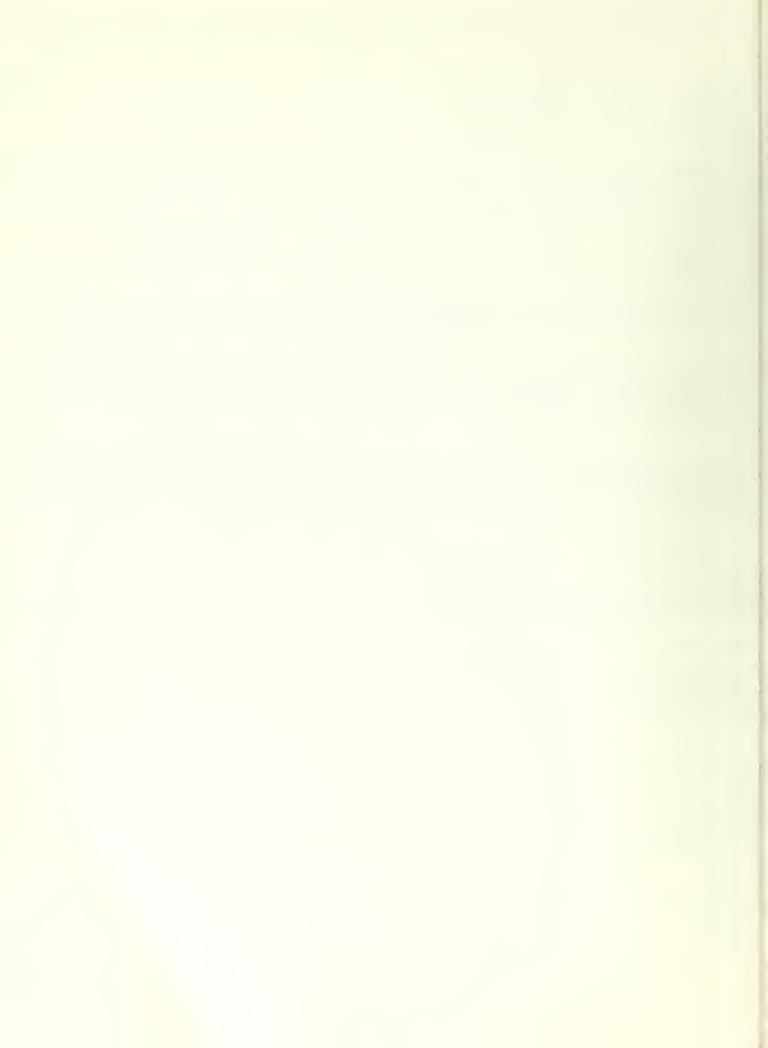
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                     ELEV 1565 ETERS
                                      1800001NG 10 4405
     LILAM USUM
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1. V DADE 1 & 1.10 1.1/1/ 11/10/ DELUA 1.0V ETERO AGE (NEG C)/1000 (DEG C)/1000
                                            -1.59
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      36.
ELEV 1585 PETERS SUUJUING 10 4398
DATE 04/09/17 TIME 05:50MST ASCENT MATE 500 FPM DATA INTERVAL 15 SEC.
                          100 01/02 D1/02 BELLIM 100 (DEG C)/100M
   INV BASE
              METERS AGE
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                               1.83
                  olu.
SHUNDING TO 4400
DATE 04/11/77 TIME 05:45 ST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
   INV BASE 197 TUP INV DI/DZ DI/DZ BELUM INV METERS AGL METERS AGL (DEG C)/100M (DEG C)/100M
   INV BASE
                                             -0.97
                  533.
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      38.
             SUUNDING ID 4402
DATE 04/13/77 TIME 05:47081 ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
   INV BASE INV TUP INV DI/DZ DI/DZ BELUM INV METERS AGL METERS AGL (DEG C)/100M
                   305.
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                        ELEV 1585 METERS
                                           SUUNDING TO 4404
       UTAH DAUS
DATE 04/13/17 TIME 13:50 ST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
               THE TUP INV DI/DZ DI/DZ BELUM INV METERS AGL . (DEG C)/TOUM
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                                      SUUNDING 1D 4391
                       ELEV 1505 METERS
      UTAH UAUB
DATE 04/15/77 TIME J5:42MST ASCENT KATE SOU FFM DATA INTERVAL IS SEC.
                       1NA DINIS DINIS PET CIM INA
   INV HASE INV TUP
METERS AGE . METERS AGE
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DATE 04/15/77 TIME 13:52MST ASCENT RATE SUC FPM DATA INTERVAL 15 SEL.
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                                    ELEV 1505 METERS
      UTAH WAUB
    MITTALL STREET TOPENT RATE SHE FEM
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UTAH UAUB ELEV 1505 NETERS SUUNDING ID 4597
             UTAH UAUB
TE 04/17/77 TIME 13:50MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
                               NETERS AGE (DEG COVIDOR (DEG COVIDOR)
   INV BASE
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UTAH UAUB ELEV 1585 METERS SOUNDING ID 4370
TE 04/19/77 TIME 05:31MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
- INV BASE INV TUP - INV DT/DZ DT/DZ BELUW INV METERS AGL METERS AGL - (DEG C)/100M (DEG C)/100M
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                                                       ELEV 1585 METERS
                                                                                                         SUUNDING ID 4392
TE 04/19/77 TIME 13:52MST ASCENT HATE 500 FPM DATA INTERVAL 15 SEC.
   INV BASE
METERS AGL
                                  HETERS AGE (DEC C)/100M (DEC C)/100M
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SUUNDING ID
TE 04/21/77 TIME 05:29MST ASCENT RATE 500 FPM DATA INTERVAL IS SEC.
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     INV BASE
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TE 04/21/77 TIME 13:50MSI ASCENI HATE 500 FPM DATA INTERVAL 15 DEC.
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   INV BASE 11.V TUP
METERS AGE METERS AGE
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                                                       TE 04/23/77 TIME US: 28MS) ASCENT RATE SOU FPM DATA INTERVAL 15 SEC.
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TE OBJUSTATION TIME TRANSPORT ASCENT BATE SOD FEM DATA INTERVAL 15 SEC.
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       WAN LAID
DATE 04/23/17 TIME 15:45051 ASCENT HATE SOU FRM DATA INTERVAL 15 SEC.
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   THE BASE METERS AGE
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                                         SOUNDING 10 4386
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                        ELEV 1565 METERS
       UTAH HAUB
DATE 04/25/77 TIME 05:25M87 TASCENT HATE 500 FPM DATA INTERVAL 15 SEC.
   INV BASE INV TOP INV DI/DZ DI/DZ BELOW INV METERS AGL METERS AGL (DEG C)/100% (DFG C)/100M
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                         LLEV 1585 METERS SOUNDING 1D 4388
DATE 04/25/77 TIME 13:50MST ASCENT HATE 500 FPM DATA INTERVAL 15 SEC.
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   INV HASE
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 DATE 04/27/77 TIME 04:21MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
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                  INV TUP
    INV BASE
    METERS AGL
                METERS AGL
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                                 0.04
                    457.
        0.
                                              SOUNDING ID 4365
                          ELEV 1585 METERS
        UTAH UAUD
 DATE 04/27/77 TIME 12:54MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
                             METERS AGE
    INV BASE
METERS AGL
                                                -0.82
                                   0.07
                    970.
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  SUUNDING ID 4387
 DATE 04/29/77 TIME 04:21MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
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                METERS AGE
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                                               SUUNDING ID 4389
                         ELEV 1585 ETERS
         UTAP UALIB
 DATE 04/29/17 TIME 12:59/61 ASCENT RITE 500 FPM DATA INTERVAL 15 SEC.
                             (DEG C)/100M DI/DZ BELOW 1kv
                 METERS ACL
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METERS AGE
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                                               SOUNDING IE 4546
                          ELEV 1505 FIES
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DATE 05/01/77 TIME 13:51 "ST ASCENT KATE 500 FPM DATA INTERVAL 15 SEC.
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SOUNDING ID 4590
DATE 05/03/77 TIME 13:490ST ASCENT RATE SOU FPM DATA INTERVAL 15 SEC.
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ELEV 1585 METERS - SUUNDING ID 4595
DATE -05/05/77 TIME 05:15MST ASCENT RATE 500 FPM DATA INTERVAL IS SEC.
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     UTAH UAUB
                      ELEV 1585 METERS
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DATE 05/05/77 TIME 13:50MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
  INV HASE THE THE TWO DIEDZ METERS AGE METERS AGE (DEG L)/100m
                                    DI/DZ BELUM INV
                                          -1.00
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                      ELEV 1585 PETERS
DATE 05/07/17 TIME 05: 00051 ASCENT RATE SOU FPM DATA INTERVAL 15 SEC.
             WELLES APT (DEC COLLOS) (DEC COLLOS)
   INV BASE
  METERS AGE
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                      ELEV 1585 METERS SUUNDING IN 4509
      UTAH HAUB
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DATE 35/67/77 TILE 15:57 (6) ASSE 1 - (16 5 ) FF . DATA I (FER AL 15 SEC.
       THERE ARE A JUENOSINA BASES ATTIMINA 1500M OF THE SEC
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ELEV 1585 BETERS
                                           SOUNDING ID 4587
DATE 05/09/77 TIME 95:00MST ASCENT HATE SUD FPM DATA INTERVAL 15 SEC.
                                      OI/DZ BELUM INV
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   INV BASE
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  METERS AGL
              METERS AGL
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ASCENT RATE SOU FPM DATA INTERVAL 15 SEC.
DATE 05/09/77 TIME 13:51MST
                          TNV DT/DZ DT/DZ BELOW INV (DEG C)/100M
              METERS AGL
   INV BASE
  METERS AGL
     317.
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SUUNDING ID 4583
      UTAH UAUR
                       FLEV 1585 METERS
DATE 05/11/77 TIME 05:03MST ASCENT HATE 500 FPM DATA INTERVAL 15 SEC.
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                       UTAH WAUB
DATE 05/11/77 TIME 13:50MST ASCENT HATE 500 FPM DATA INTERVAL 15 SEC.
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              METERS AGE
                  359
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ELEV 1565 METERS SOUNDING TO 4568
      UTAH UALID
DATE 05/13/77 TIME 05:02MST ASCENT RATE SOU FPM DATA INTERVAL 15 SEC.
                           110 1110Z DI/DZ BELD* INV
              METERS ALL
   INV BASE
  METERS- AGL
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                       ELEV 1565 PETERS SUUNDING ID 4586
      UTAH UAUB
                        ASCENT MATE SOU FEM DATA INTERVAL 15 SEC.
VATE 05/13/77 TIME 13:52 ST
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DATE 65/15/77 71 + 15:50 . 1 ASCHOT MATE SILFF DATE INTERVAL 15 SEC.
        THE BASE THE TOTAL TOTAL
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                    UTAH WAUB
DATE 05/15/77 TIME 05:02MST ASCENT PATE 500 FPM DATA INTERVAL 15 SEC.
                                         THE TUP INV DI/DZ DI/DZ BELDW INV METERS AGE (DEG C)/100M (DEG C)/100M
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                   UTAH UAUH
                                                               ELEV 1505 HETTAS
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DATE 05/15/77 TIME 13:53MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
                     THERE ARE NO 1' VEHSION BASES WITHIN 1500M OF THE SEC
                          LAYER BASE LAYER TUP , DT/DZ
METERS AGL METERS AGL (DEG C)/100M
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                   HUAU HATU
                                                                  ELEV 1585 HETERS
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DATE 05/17/77 TIME 05: HOUST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
        INV BASE INV THE INV DIVE DIVOZ BELON INV METERS AGE HETERS AGE (DEG C)/100M (DEG C)/100M
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                                                               ELEV 1585 METERS
                                                                                                                      SUUNDING 10 4578
                  UTAH UAUH
DATE US/17/77 TIME 13:55%SI ASCENT RATE SUU FPM DATA INTERVAL 15 SEC.
       NETERS AGE METERS AGE. METERS AGE. METERS AGE. METERS AGE.
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                 484.
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                                                                ELEV 1505 ETEKS SUUNUING ID 4570
                  UTAH LIALIB
DATE 05/19/77 TIME 04:58081 ASCENT RATE 500 FFM DATA INTERVAL 15 SEC.
                                       11 V TUP
                                                                         The DIADY DIADY REFORDING
       INV BASE
METERS AGE
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SOUNDING 10 4574
DATE 05/19/77 TIME 15:52 OF ASCENT HATE SUD FPM DATA INTERVAL 15 SEC.
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16 05/19/17 11 6 15:00 1 ANCH 1 MAIS SEC FP WATER I TERVEL 15 SEC.
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UTAH UAUD ELEV 1505 NETEKS SIUNDING ID 4579
TE 05/21/77 TIME 05:02/81 ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
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    INV RASE
METERS AGE
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ATE 05/21/77 TIME 13:52 MST ASCENT RATE SOO FPH DATA INTERVAL 15 SEC.
                 THERE ARE NO INVERSION BASES WITHIN 1500M OF THE SEC
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ATE 05/23/77 TIME 04:55MST ASCENT HATE 500 FPM DATA INTERVAL 15 SEC.
                                   METERS AGE (DEG C)/100M (DEG C)/100M
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ATE US/23/77 TIME 13:50MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
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              UTAH WASS ELEV 1565 ETERS
                                                                ASCENT HATE SOU FPM - DATA INTERVAL 15 SEC.
PATE 05/25/77 FIFE 04:53761
                                                                       TRV UT/OZ DT/OZ BELOW INV
                                     THE THIS AGE
     1.VV BASE
METERS AGL
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DATE US/25/77 TIME 13:51057 ASCENT MATE SUU FPM DATA INTERVAL 15 SEC.
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DATE 17/25/77 11 5 15:50 1 1561:11 ": TO SIN FP". USTE 1 TO NOTE 15 SEC.
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  1. FIELS AGE
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                      ELEV 1505 ETERS SUUNDING ID 4803
UTAH UAUB ELLV 1
DATE 05/27/77 TIME 04:52MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
  THY BASE 10 TOP INV DIVOZ DIVOZ BELOW INV METERS AGL METERS AGL (DEG C)/100M (DEG C)/100M
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       U.
UTAH DAUS FLEV 1585 METERS SOUNDING 1D 4802
PATE US/27/77 TIME 12:59MST ASCENT RATE 500 FPM DATA INTERVAL 15 SEC.
           THE TUP TO THE SELUM INV METERS AGE - (DEG C)/100M (DEG C)/100M
  INV BASE
METERS AGL
   1445.
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                               (1, 1)
ATE 05/29/77 TIME 04:51 MST ASCENT HATE 500 FPM DATA INTERVAL 15 SEC.
            THE TERS AGE (DEG C)/100M (DEG C)/100M
  INV BASE .
METERS AGE
                                            0.0
                  762
                            0.57
UTAH DAUH ELEV 1585 METERS SUUNDING ID 4809
ATE 05/29/77 TIME 13:50MST ASCENT HATE 500 FPM DATA INTERVAL 15 SEC.
              METERS AGE
                          (DEG C)/100M DI/DZ BELUW INV
  INV BASE
METERS AGL
                                            -1.84
                               0.70
    133.
               2.10.
ATE 05/31/77 TIME 04:48 ST ASCENT HATE 500 FPM DATA INTERVAL 15 SEC.
  THE BASE - 1.4 TUP INV DIVOZ DIVOZ BELUM INV METERS AGE . METERS AGE (DEG C)/100% (DEG C)/100%
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               nu".
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     U.
             ATE US/31/77 TIME 15:5. THE ASCENT HATE SOU FFT DATA INTERVAL 15 SEC.
  THY BASE I TOP TO THE DIAZ BELDA INV
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